REMARKS

The Official Action dated January 31, 2001 has been carefully considered. Accordingly, the changes presented herewith, taken with the following remarks, are believed sufficient to place the present application in condition for allowance. Reconsideration is respectfully requested.

By the present amendment, Claims 7 and 13 have been cancelled above. Claim 1 has been amended to recite the adhesive as anisotropic electrically conductive, i.e., anisotropic conductive, and an electrically conductive filler, i.e., a conductive filler, in accordance with the teachings of the specification at pages 35-40 and in Examples 19-26. Claims 4-6, 8-10, 12 and 15 have been amended for several matters of form. A Version With Markings Showing Changes Made is attached. Claims 20-29 have been added. Support for Claims 20 and 21 may be found in the specification at page 40, lines 8-18, in Examples 19-26 and in the drawing. Support for Claims 22-24 may be found in the specification at page 38, lines 6-15. Support for Claims 25 and 26 may be found in the specification at page 16, lines 16-22. Support for Claims 27 and 28 may be found in the paragraph bridging pages 38 and 39 of the specification. Support for Claim 29 may be found in the specification at page 48, lines 20-26. It is believed that these changes do not involve any introduction of new matter, whereby entry is believed to be in order and is respectfully requested.

In the Official Action, Claims 4, 5 and 12 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite in recitation of the cycloolefin polymer. By the present amendment, Claims 4-6 and 12 have been amended to clearly define the cyclic structure-containing thermoplastic polymer. It is therefore submitted that these claims are definite and that the rejection has been overcome. Reconsideration is respectfully requested.

Claims 1-19 were rejected under 35 U.S.C. §102 as being anticipated by the Sugio et al U.S. Patent No. 4,503,186. The Examiner asserted that Sugio et al teach a curable resin

adhesive composition comprising a polyphenylene ether resin having a number average molecular weight of about 1,000 to about 30,000. The Examiner asserted that Sugio et al teach that natural reinforcing materials or fillers, including non-conductive inorganic and conductive fillers, may be incorporated.

However, as will be set forth in detail below, Applicants submit that the anisotropical electrically conductive adhesive for semiconductor parts, adhesive films, semiconductor part packages and processes defined by claims 1-6, 8-12 and 14-19 are not anticipated by and are patentably distinguishable from the teachings of Sugio et al. Accordingly, this rejection is traversed, and reconsideration is respectfully requested.

More particularly, as defined by independent Claim 1, the present invention is directed to an anisotropic electric conductive adhesive for semiconductor parts. The adhesive comprises a cyclic structure-containing thermoplastic polymer selected from the group consisting of (a) a cycloolefin polymer and (b) an aromatic-condensed polymer having a repeating unit of an aromatic ring in its main chain, and having a number average molecular weight of 1,000 to 500,000, and an electrically conductive filler. The adhesive has anisotropic electrical conductivity. Claim 16 is directed to an adhesive film for semiconductor parts formed from the adhesive, while claim 17 is directed to a semiconductor part package obtained by bonding a semiconductor part to a substrate with a solution or film of the adhesive.

Claim 18 and new claim 20 are directed to processes for producing a semiconductor part package, which processes comprise laminating an adhesive film obtained by forming a film from the anisotropic conductive adhesive of claim 1. Claim 19 and new claim 21 are directed to processes for producing a semiconductor part package, which processes comprise, inter alia, applying a solution of the anisotropic conductive adhesive of claim 1.

When using the anisotropic conductive adhesive for semiconductor parts according to the invention, the conductive filler dispersed in the cyclic structure-containing thermoplastic polymer is present on connection terminals with a certain probability, and the conductive filler is squeezed from point contact to a state close to face contact by applying heat and pressure, thereby producing conductivity and at the same time fully bonding a semiconductor part to a substrate to achieve stable bonding. However, lateral insulation properties are achieved, while maintaining conductivity between upper and lower terminals, by controlling the amount of the conductive filler dispersed therein.

As the miniaturization and high-density packaging of electronic parts progress, terminal intervals are reduced and demands for coping with the formation of fine-pitch patterns and ensuring high reliability at joints are increased. However, conventional anisotropic conductive materials cannot sufficiently cope with the formation of a fine-pitch pattern. In fine-pitch patterns, for example, the width of a beam lead in a beam lead type semiconductor chip is 50 to 100μm, and an interval between beam leads is about 50 to 100μm. When bump bonding is conducted with conventional anisotropic conductive materials on such an electronic part in which a fine-pitch pattern has been formed, it is difficult to ensure insulating properties between bumps.

However, the anisotropic conductive adhesive according to the present invention can meet these demands because the base polymer is excellent in dielectric properties, as demonstrated in Examples 19-26 in the present specification. Thus, the anisotropic conductive adhesive according to the present invention provides electrode to electrode electrical connection while maintaining lateral electrical insulation.

Sugio et al disclose a curable resin composition comprising (a) a polyphenylene resin, (b) a maleimide compound and/or a cyanate ester compound and (c) at least one compound selected from the group consisting of compounds having one or more acryloyl, methacryloyl,

acryloxy or methacryloxy groups. Sugio et al broadly disclose that reinforcing materials or fillers in fibrous or powdery form may be incorporated in the curable resin composition (column 10, lines 36-44). Sugio et al further disclose that examples of the powdery reinforcing materials or fillers are carbon black, finely divided silica, fired clay, basic magnesium silicate, powdery diatomaceous earth, alumina, calcium carbonate, magnesium carbonate, magnesium oxide, kaolin, sericite and boron nitride.

However, these powdery materials disclosed by Sugio et al are merely reinforcing materials or fillers for improving mechanical strength and are not electrically conductive fillers. Applicant specifically notes that the carbon black described by Sugio et al is a reinforcing type carbon black and is not a conductive carbon black. Applicant finds no disclosure in Sugio et al relating to an electrically conductive filler.

More particularly, Sugio et al describe that the curable resin composition finds application in various fields, including paints for rust-proofing, fire and flame retarding and the like purposes, electrical insulating varnishes, adhesives, molding materials, various laminating materials including fiber-reinforced laminates, and materials for printed circuit boards (column 11, lines 20-43). Thus, one skilled in the art will clearly recognize that the curable resin composition of Sugio et al has an electrical insulating property, and if the curable resin composition of Sugio et al is employed for bonding a semiconductor and a substrate, it would be impossible to electrically connect both electrodes to each other. Sugio et al neither teach nor suggest an anisotropic electrically conductive adhesive.

Anticipation under 35 U.S.C. §102 requires the disclosure in a single prior art reference of each element of the claims under consideration, *Alco Standard Corp. v. TVA*, 1 U.S.P.Q.2d 1337, 1341 (Fed Cir. 1986). In view of the failure of Sugio et al to teach an anisotropic electrically conductive adhesive including an electrically conductive filler, Sugio et al do not disclose each element of the claims under consideration and therefore do not

anticipate claims 1-6, 8-12 and 14-19 under 35 U.S.C. §102. It is therefore submitted that the rejection based on Sugio et al has been overcome, and reconsideration is respectfully requested.

Claims 1-6, 11, 12 and 16 were rejected under 35 U.S.C. §102(b) as being anticipated by the Minami et al U.S. Patent No. 5,179,171. Claims 7-10 and 13-15 were rejected under 35 U.S.C. §103 as being obvious and unpatentable over Minami et al while Claims 17-19 were rejected under 35 U.S.C. §103 as being unpatentable over Minami et al in view of the admitted prior art regarding pressurizing and heating to a temperature higher than the Tg of an adhesive material to bond an adhesive material to a substrate or to bond two parts together. The Examiner asserted that Minami et al teach a random copolymer comprising polymerized units from ethylene and at least one cycloolefin wherein the copolymer may be mixed with lubricants and fillers. The Examiner referred to the exemplary fillers set forth by Minami et al at column 15, lines 41-52.

However, as will be set forth in detail below, Applicant submits that the adhesives for semiconductor parts, adhesive films, semiconductor part packages and processes defined by claims 1-6, 8-12 and 14-19 are neither anticipated by nor rendered obvious over Minami et al, alone or in view of the admitted prior art relating to pressurizing and heating. Accordingly, these rejections are traversed and reconsideration is respectfully requested.

As discussed in detail above, claim 1 is directed to an anisotropic electrically conductive adhesive for semiconductor parts, which adhesive comprises a cyclic structure-containing thermoplastic polymer selected from the group consisting of a cycloolefin polymer and an aromatic-condensed polymer having a repeating unit of an aromatic ring in its main chain, and having a number average molecular weight of 1,000 to 500,000, and an electrically conductive filler. Claim 16 is directed to an adhesive film for semiconductor parts formed from the adhesive, while claim 17 is directed to a semiconductor part package

obtained by bonding a semiconductor part to a substrate with a solution or film of the adhesive. Finally, claims 18 and 19 are directed to processes for producing a semiconductor part package by laminating an adhesive film formed from the adhesive or by applying a solution of the adhesive, respectively.

Minami et al disclose a random addition copolymer of ethylene and a cycloolefin. However, while Minami et al discuss the molecular weight distribution of their copolymer, Applicant does not find a clear disclosure by Minami et al of the molecular weight of their copolymer. Moreover, Minami et al disclose that their copolymer has excellent electrical insulating properties. While Minami et al broadly disclose that various fillers may be added to their copolymer, Applicant finds no specific example where a filler, particularly an electrically conductive filler, is contained in the copolymer.

Minami et al broadly describe that their random copolymer having a low molecular weight can be used in electrical insulating materials, hot-melt adhesives and the like, while their random copolymer having a high molecular weight can be used in transparent electrically conductive sheets or films (columns 15 to 16). However, a mere electrically insulating material fails to electrically connect an electrode of a semiconductor part to an electrode on a circuit board. On the other hand, an electrically conductive material such as a transparent electrically conductive film fails to ensure electrical insulating properties between adjacent electrodes. Accordingly, Minami et al neither disclose nor suggest a composition having anisotropic electrical conductivity or how such a property is imparted to the random copolymer.

On the other hand, the adhesive according to the present invention comprises a cyclic structure-containing thermoplastic polymer having a number average molecular weight of 1,000 to 500,000, and an electrically conductive filler and is an anisotropic electrically conductive adhesive for semiconductor parts. According to the present invention, an

electrode of a semiconductor part can be electrically connected to an electrode on a circuit board by using such an anisotropic electric conductive adhesive. In addition, electrical insulation between adjacent electrodes can be achieved. Applicant finds no teaching or suggestion by Minami et al relating to such a composition.

In view of the failure of Minami et al to disclose an anisotropic electrically conductive adhesive, particularly comprising a cyclic structure-containing thermoplastic polymer and an electrically conductive filler as required by claim 1, Minami et al do not disclose each element of the claims under consideration and therefore do not anticipate the present claims under 35 U.S.C. §102, *Alco Standard Corp. v. TVA, supra.*

Moreover, Minami et al do not render the anisotropic electrically conductive adhesive according to the present invention obvious. That is, references relied upon to support a rejection under 35 U.S.C. §103 must provide an enabling disclosure, i.e., they must place the claimed invention in the possession of the public, *In re Payne*, 203 U.S.P.Q. 245 (CCPA 1979). While Minami et al disclose a random copolymer having a low molecular weight can be used in electrically insulating materials and a random copolymer having a high molecular weight can be used in transparent electrically conductive sheets or films, Applicant finds no teaching, suggestion or recognition by Minami et al that an anisotropic electrically conductive adhesive composition according to the present invention may be provided by a combination of a cyclic structure-containing thermoplastic polymer and an electrically conductive filler as defined by the present claims. Thus, Minami et al do not provide an enabling disclosure of the presently claimed adhesives and do not place the presently claimed adhesives in the possession of the public. Thus, Minami et al do not support a rejection under 35 U.S.C. §103.

It is therefore submitted that the adhesives, adhesive films, semiconductor part packages and processes defined by claims 1-6, 8-12 and 14-19 are neither anticipated by nor

rendered obvious over Minami et al, whereby the rejections under 35 U.S.C. §§ 102 and 103 have been overcome. Reconsideration is respectfully requested.

Claims 1-6, 11, 12, and 16-19 were rejected under 35 U.S.C. §102(b) as being anticipated by the McIntosh, III et al U.S. Patent No. 5,912,313. Claims 7-10 and 13-15 were rejected as being obvious and unpatentable over McIntosh, III et al. The Examiner asserted that McIntosh, III et al teach silyl-substituted polymers of polycycloolefins with molecular weights ranging from 5,000 to about 500,000. The Examiner asserted that McIntosh, III et al also disclose that the polymers can be filled with high dielectric constant ceramics or silica or other fillers including conductive and non-conductive fillers.

However, Applicant submits that the adhesives, adhesive films, semiconductor part packages and processes defined by claims 1-6, 8-12 and 14-19 are neither anticipated by nor rendered obvious over McIntosh, III et al. Accordingly, these rejections are traversed, and reconsideration is respectfully requested.

The adhesives, films, semiconductor part packages and processes defined by the present claims are discussed in detail above. Importantly, the adhesives according to the present invention are anisotropic electrically conductive and comprise the cyclic structure-containing thermoplastic polymer and the electrically conductive filler.

McIntosh, III et al disclose silyl substituted polymers of polycycloolefins and that a filler having a high dielectric constant (high electrically insulating property) can be incorporated. More specifically, high dielectric constant ceramics such as barium titanate, lead zirconate titanate (PTZ) and lead lanthanum zirconate titanate (PLZT), metal oxides such as SiO_2 and TiO_2, and pigments are disclosed by McIntosh, III et al (column 21, line 48-column 22, line 14). Accordingly, the fillers of McIntosh, III et al are incorporated for enhancing the thermal conductivity of the polymers. McIntosh, III et al describe that

"Materials with high thermal conductivity but electrically insulative are particularly preferred" (column 22, lines 12-14).

Applicant finds no teaching or suggestion by McIntosh, III et al relating to an adhesive which is anisotropic electrically conductive or which comprises a cyclic structure-containing thermoplastic polymer as defined in claim 1 in combination with an electrically conductive filler. To the contrary, McIntosh, III et al employ thermally conductive but electrically insulative fillers. In view of the failure of McIntosh, III et al to disclose anisotropic electrically conductive adhesives comprising an electrically conductive filler, McIntosh, III et al do not disclose each element of the claims under consideration and therefore do not anticipate the present claims under 35 U.S.C. §102, *Alco Standard Corp. v. TVA, supra*. Moreover, these deficiencies prevent McIntosh, III et al from providing an enabling disclosure of the presently claimed invention and prevent McIntosh, III et al from placing the presently claimed invention in the possession of the public. Thus, McIntosh, III et al do not support a rejection under 35 U.S.C. §103, *In re Payne, supra*.

It is therefore submitted that the adhesives, films, semiconductor part packages and processes defined by claims 1-6, 8-12 and 14-19 are neither anticipated by nor rendered obvious over McIntosh, III et al, whereby the rejections under 35 U.S.C. §§ 102 and 103 have been overcome. Reconsideration is respectfully requested.

It is believed that the above represents a complete response to the Examiner's rejections under 35 U.S.C. §§ 102, 103 and 112, second paragraph, and places the present application in condition for allowance. Reconsideration and an early allowance are requested.

Respectfully submitted,

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VERSION WITH MARKINGS SHOWING CHANGES MADE

1. (Amended) An anisotropic electrically conductive adhesive for semiconductor parts, comprising [, as a base polymer, at least one]:

a cyclic structure-containing thermoplastic polymer selected from the group consisting of (a) a cycloolefin polymer and (b) an aromatic-condensed polymer having a repeating unit of an aromatic ring in its main chain, and having a number average molecular weight of 1,000 to 500,000, and

an electrically conductive filler,

whereby the adhesive has anisotropic electrical conductivity.

4. (Twice Amended) The adhesive for semiconductor parts according to Claim 1, wherein the cyclic structure-containing thermoplastic polymer [cycloolefin polymer (a)] is at least one thermoplastic norbornene resin selected from the group consisting of (1) an addition (co)polymer of an alicyclic monomer having a norbornene ring, (2) an addition copolymer of an alicyclic monomer having a norbornene ring and a vinyl compound, (3) a ring-opening (co)polymer of an alicyclic monomer having a norbornene ring, and (4) a hydrogenated product of the ring-opening (co)polymer of the alicyclic monomer having a norbornene ring.

5. (Twice Amended) The adhesive for semiconductor parts according to Claim 1, wherein the cyclic structure-containing thermoplastic polymer [cycloolefin polymer (a)] is at least one selected from the group consisting of an addition polymer of a cyclic conjugated diene monomer and a hydrogenated product of the addition polymer.

6. (Twice Amended) The adhesive for semiconductor parts according to Claim 1, wherein the <u>cyclic structure-containing thermoplastic polymer</u> [aromatic-condensed polymer (b)] is poly(phenylene ether).

8. (Third Amendment) The adhesive for semiconductor parts according to Claim 1, [which is composed of a resin composition comprising a] <u>wherein the amount of the</u> conductive filler [in a proportion of] is 1 to 100 parts by weight [per] <u>based on</u> 100 parts by weight of the cyclic structure-containing thermoplastic polymer.

9. (Amended) The adhesive for semiconductor parts according to Claim [8] <u>1</u>, [which is an anisotropic conductive material] <u>wherein the filler is a micro-capsulate conductive filler</u>.

10. (Third Amendment) The adhesive for semiconductor parts according to Claim 1, [which is composed of a resin composition] <u>further</u> comprising a low-molecular weight resin in a proportion of 1 to 50 parts by weight per 100 parts by weight of the cyclic structure-containing thermoplastic polymer.

12. (Amended) The adhesive for semiconductor parts according to Claim 2, wherein the <u>cyclic structure-containing thermoplastic polymer</u> [cycloolefin polymer (a)] is a modified polymer obtained by graft-modifying<u>, with a functional group-containing unsaturated compound,</u>

a hydrogenated product of a ring-opening copolymer of tetracyclododecene or a derivative thereof,

an addition copolymer of tetracyclododecene or a derivative thereof and a vinyl compound, or

a hydrogenated product of an addition polymer of 1,3-cyclohexadiene [with a functional group-containing unsaturated compound].

15. (Third Amendment) The adhesive for semiconductor parts according to Claim [1, which is composed of a resin composition comprising, per 100 parts by weight of the cyclic structure-containing thermoplastic polymer,] <u>10, wherein the amount of the conductive filler is</u> 1 to 100 parts by weight [of a filler and 1 to 50 parts by weight of a low-molecular weight resin] <u>based on 100 parts by weight of the cyclic structure-containing thermoplastic polymer</u>.

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